International Journal of Agricultural Sciences
Volume 9 | Issue 1| January, 2013 | 95-99

***RESEARCH PAPER***

# Effect of chemical fertilizer and vermicompost on yield and nutrient content and uptake by leaf of banana (*Musa parasidiaca* L.) cv. GRAND NAINE

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**Abstract :** The experiment was carried out at jambuvadi farm, Department of Horticulture,Junagadh Agricultural University, Junagadh during 2008-09 and 2009-10 to study effect of chemical fertilizer and vermicompost on yield nutrient and content and uptake in leaf of banana cv. GRAND NAINE. The highest yield, content and uptake by leaf of banana were recorded with the application $F_2$( Full recommended doze) and $V_3$(8 kg vermicompost) in the both year and pooled results, but it was at par with the treatment $F_1$ and $V_2$ in both the year and pooled results, respectively. The interactive effects between fertilizer levels and vermicompost (FxV), (YxF), (YxV), and (YxFxV) in yield,content and uptake by leaf of banana were found non significant during both the years as well as in pooled results.

**Key Words :** Banana, Grand Naine, NPK**,** Leaf, Content, Uptake

**View Point Article :** Butani, A.M., Chovatia, R.S., Patel, K.D., Vadaria, K.N. and Rankja, N.J. (2013). Effect of chemical fertilizer and vermicompost on yield and nutrient content and uptake by leaf of banana (*Musa parasidiaca* L.) cv. GRAND NAINE. *Internat. J. agric. Sci.*, **9**(1): 95-99.

**Article History : Received :** 13.06.2012**; Revised :** 01.09.2012**; Accepted :** 26.10.2012

## INTRODUCTION

Banana (*Musa paradisiaca* L.) is an important fruit crop in tropical and sub tropical regions. The fruit is delicious and seedless in nature. It is a staple food for millions of people and most important commercial fruit of the tropical areas of the world. In India, banana is grown in different agroclimatic conditions. On a commercial scale, it is being cultivated in Tamil Nadu, Maharashtra, Assam, Karnataka, Andrapradesh, Orissa ,Gujarat, Bihar, Kerala and West Bengal. At together contribute over 62 per cent to the country's total banana production (Anonymous,2010a). The area under banana in India is 646.9 lakh ha with production of 232.04 lakh tones and productivity is about 35.9 MT per ha (Anonymous, 2010b). In Gujarat, mostly banana crop is grown in south Gujarat. Banana growing major districts are Bharuch, Narmada, Junagadh, Kheda, Surat and Baroda. At the present level of area and production, it occupies about 6.19 lakh hectares of land and production is about 3779.8 MT and productivity is about 64.8 MT per hectare in Gujarat (Anonymous, 2010b). Grand Naine variety of banana is a popular variety grown mostly in all export oriented countries of Asia, South America and Africa. Due to several desirable traits like excellent fruit quality, resistance to *Fusarium wilt* etc., it has proved better variety. However, its organic and inorganic requirement is not well documented for the Gujarat region.Keeping these aspects in mind, the present investigation was undertaken to find out the suitable combination of organic and inorganic fertilizers for banana cv. GRAND NAINE.

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## MATERIALS AND METHODS

The field experiment was conducted on effect of chemical fertilizer and vermicompost on yield and nutrient content and uptake by leaf of banana (*Musa parasidiaca* L.) cv. GRAND NAINE during 2008-09 and 2009-10 at Jambuvadi Farm, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh. A Factorial Randomized Block Design (FRBD) consisting three levels of chemical fertilizer and four levels of vermicompost with four replications was employed with twelve treatment combinations in the experiment. As per treatments, dose of nitrogen, $P_2O_5$ and $K_2O$ were applied in the form of urea, DAP ( Diammonium phosphate) and murate of potash, respectively. Banana is a voracious feeder of nutrients, so the N, P, and K fertilizers and vermicompost were applied in three equal splits as per treatments in the 3rd week of August, September and October in first year as well as in ratoon crop (Second year). The soil was clayey in texture and slightly alkaline. Leaf samples were collected from the plant and ratoon crop and analysed. Treatment combinations were as under.

**Treatments details :**

*Fertilizer dose (Three)*:

$F_0$ = No fertilizer
$F_1$ = 150- 45 - 100g NPK/plant (half dose of RDF)
$F_2$ = 300- 90 - 200g NPK/plant (Full dose of RDF)

*Vermicompost (Four)* :

$V_0$ = No vermicompost
$V_1$ = 4kg vermicompost/plant
$V_2$ = 6kg vermicompost/plant
$V_3$ = 8kg vermicompost/plant

**Treatment combinations :**

– $F_0V_0$ = No chemical fertilizer + No vermicompost
– $F_0V_1$ = No chemical fertilizer + 4kg vermicompost/plant
– $F_0V_2$ = No chemical fertilizer + 6kg vermicompost/plant
– $F_0V_3$ = No chemical fertilizer + 8kg vermicompost/plant
– $F_1V_0$ = 150-45-100g NPK/plant + No vermicompost
– $F_1V_1$ = 150-45-100g NPK/plant + 4kg vermicompost/plant
– $F_1V_2$ = 150-45-100g NPK/plant + 6kg vermicompost/plant
– $F_1V_3$ = 150-45-100g NPK/plant + 8kg vermicompost/plant
– $F_2V_0$ = 300-90-200g NPK/plant + No vermicompost
– $F_2V_1$ = 300-90-200g NPK/plant + 4kg vermicompost/plant
– $F_2V_2$ = 300-90-200g NPK/plant + 6kg vermicompost/plant
– $F_2V_3$ = 300-90-200g NPK/plant + 8kg vermicompost/plant

## RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

**Yield per plant (kg) and yield per hectare :**

*Effect of fertilizer* :

The results indicated significant effect of fertilizer levels on yield during both the years and in pooled results (Table 1). Application of 300-90-200g NPK per plant, full dose of RDF ($F_2$) exerted the highest yield per plant and per hectare during

**Table 1 : Effect of chemical fertilizers and vermicompost on yield per plant (kg) and per hectare (ton) of banana cv. GRAND NAINE**

| Treatments | Yield per plant (kg) | | | Yield per hectare (ton) | | |
|---|---|---|---|---|---|---|
| | 2008-09 | 2009-10 | Pooled | 2008-09 | 2009-10 | Pooled |
| **Fertilizer levels (F)** | | | | | | |
| $F_0$ | 10.795 | 6.913 | 8.854 | 33.31 | 21.33 | 27.32 |
| $F_1$ | 19.593 | 13.436 | 16.514 | 60.46 | 41.46 | 50.96 |
| $F_2$ | 20.017 | 14.579 | 17.110 | 61.77 | 45.76 | 53.19 |
| S.E. ± | 0.675 | 0.5787 | 0.444 | 6.75 | 5.79 | 4.44 |
| C.D. at 5 % | 1.944 | 1.663 | 1.755 | 19.44 | 16.63 | 17.55 |
| **Vermicompost (V)** | | | | | | |
| $V_0$ | 10.645 | 6.962 | 8.803 | 32.85 | 21.48 | 27.17 |
| $V_1$ | 15.187 | 11.013 | 13.100 | 46.87 | 33.99 | 40.43 |
| $V_2$ | 19.968 | 13.441 | 16.704 | 61.62 | 41.48 | 51.55 |
| $V_3$ | 20.906 | 15.154 | 18.030 | 64.52 | 46.77 | 55.64 |
| S.E. ± | 0.779 | 0.667 | 0.513 | 7.79 | 6.67 | 5.13 |
| C.D. at 5 % | 2.244 | 1.920 | 1.255 | 22.44 | 19.20 | 12.55 |
| **Interaction (FxV)** | | | | | | |
| S.E. ± | 1.350 | 1.155 | 1.314 | 13.50 | 11.55 | 13.14 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| Pooled | Y X F | Y X V | Y X F X V | Y X F | Y X V | Y X F X V |
| S.E. ± | 0.628 | 0.725 | 1.256 | 6.28 | 7.25 | 12.56 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| C.V. % | 16.19 | 19.84 | 17.75 | 16.19 | 19.84 | 17.75 |

* and ** Indicate significance of values at P=0.05 and 0.01, respectively NS= Non-significant

both the year and pooled results, but it was at par with treatments $F_1$ (150- 45 - 100g NPK per plant, half dose of RDF) during the years 2008-09, 2009-10 and in pooled results. Significantly the minimum yield per plant and per hectare was produced with treatment $F_1$ (without fertilizer) during both the years and in pooled results.

*Effect of vermicompost* :

Maximum yield per plant and per hectare was reported under the treatment of 8kg vermicompost per plant ($V_3$) during 2008-09, 2009-10 and in pooled results, while it remained statistically at par with $V_2$ (6kg vermicompost per plant) in the year of 2008-09, 2009-10 and in pooled results. Significantly the lowest yield per plant and per hectare were obtained under treatment $V_0$ (No vermicompost) during 2008-09, 2009-10 and in pooled results.

**Nitrogen content (%)and uptake (kg/ha) by leaf of banana plant :**

*Effect of fertilizer* :

The results summarized in Table 2 showed that fertilizer levels significantly affected the nitrogen content and uptake (kg/ha) by fruit of banana during both the years as well as in pooled results. Application of 300-90-200g NPK per plant ($F_2$) recorded the highest nitrogen content and uptake (kg/ha) by fruit of banana during both the years and in pooled results but remained at par with treatment $F_1$ (150-45-100g NPK per plant). Significantly the lowest nitrogen content and uptake (kg/ha) by leaf of banana was observed without application of fertilizers ($F_0$) in both the years as well as in pooled results.

*Effect of vermicompost* :

The data presented in Table 2 revealed that nitrogen content and uptake (kg/ha) in leaf of banana varied significantly during both the years as well as in pooled results. Application of 8kg vermicompost per plant ($V_3$) recorded the highest nitrogen content and uptake by leaf of banana during 2008-09, 2009-10 and in pooled results, but remained statistically at par with treatment $V_2$ (6kg vermicompost per plant). Significantly the minimum nitrogen content and uptake were reported under the treatment $V_0$ (no vermicompost) in both the years and in pooled results.

**Phosphorus content (%)and uptake (kg/ha) by leaf of banana plant :**

*Effect of fertilizer* :

The data presented in Table 3, revealed that application of 300-90-200g NPK per plant ($F_2$) recorded the highest phosphorus content and uptake in leaf of banana during the year 2008-09, 2009-10 and in pooled results. But it was equally effective with treatment $F_2$ (150-45-100g NPK per plant) in the year of 2008-09, 2009-10 and pooled results. Significantly the minimum phosphorus content and uptake in leaf of banana was observed without frtilizer ($F_0$) in both the years and in

**Table 2: Effect of chemical fertilizers and vermicompost on leafnitrogen content %)and nitrogen uptake (kg/ha) of banana cv. GRAND NAINE**

| Treatments | Nitrogen content (%) | | | Nitrogen uptake (kg/ha) | | |
|---|---|---|---|---|---|---|
| | 2008-09 | 2009-10 | Pooled | 2008-09 | 2009-10 | Pooled |
| **Fertilizer levels (F)** | | | | | | |
| $F_0$ | 0.83 | 0.82 | 0.83 | 0.095 | 0.059 | 0.077 |
| $F_1$ | 1.21 | 1.15 | 1.18 | 0.243 | 0.160 | 0.201 |
| $F_2$ | 1.30 | 1.18 | 1.24 | 0.260 | 0.173 | 0.217 |
| S.E. ± | 0.044 | 0.05 | 0.032 | 0.012 | 0.009 | 0.014 |
| C.D. at 5 % | 0.125 | 0.131 | 0.089 | 0.035 | 0.026 | 0.086 |
| **Vermicompost (V)** | | | | | | |
| $V_0$ | 0.96 | 0.95 | 0.953 | 0.115 | 0.072 | 0.093 |
| $V_1$ | 1.02 | 0.95 | 0.99 | 0.160 | 0.107 | 0.134 |
| $V_2$ | 1.20 | 1.11 | 1.15 | 0.248 | 0.159 | 0.202 |
| $V_3$ | 1.27 | 1.20 | 1.23 | 0.274 | 0.188 | 0.231 |
| S.E. ± | 0.050 | 0.053 | 0.036 | 0.014 | 0.011 | 0.009 |
| C.D. at 5 % | 0.145 | 0.152 | 0.089 | 0.041 | 0.031 | 0.040 |
| **Interaction (FxV)** | | | | | | |
| S.E. ± | 0.087 | 0.091 | 0.068 | 0.025 | 0.018 | 0.028 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| Pooled | Y X F | Y X V | Y X F X V | Y X F | Y X V | Y X F X V |
| S.E. ± | 0.045 | 0.051 | 0.089 | 0.011 | 0.012 | 0.022 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| C.V. % | 15.66 | 17.38 | 16.50 | 14.63 | 18.00 | 16.24 |

* and ** Indicate significance of values at P= 0.05 and 0.01, respectively NS= Non-significant

**Table 3 : Effect of chemical fertilizers and vermicompost on leaf phosphorus content (%) and phosphorus uptake (kg/ha) of banana cv. GRAND NAINE**

| Treatments | Phosphorus content (%) | | | Phosphorus uptake (kg/ha) | | |
|---|---|---|---|---|---|---|
| | 2008-09 | 2009-10 | Pooled | 2008-09 | 2009-10 | Pooled |
| **Fertilizer levels (F)** | | | | | | |
| $F_0$ | 0.09 | 0.09 | 0.09 | 0.011 | 0.007 | 0.009 |
| $F_1$ | 0.13 | 0.12 | 0.13 | 0.025 | 0.017 | 0.021 |
| $F_2$ | 0.135 | 0.13 | 0.13 | 0.027 | 0.020 | 0.023 |
| S.E. ± | 0.004 | 0.005 | 0.003 | 0.001 | 0.001 | 0.001 |
| C.D. at 5 % | 0.011 | 0.014 | 0.009 | 0.004 | 0.003 | 0.002 |
| **Vermicompost (V)** | | | | | | |
| $V_0$ | 0.11 | 0.10 | 0.11 | 0.013 | 0.008 | 0.010 |
| $V_1$ | 0.11 | 0.10 | 0.11 | 0.017 | 0.013 | 0.015 |
| $V_2$ | 0.13 | 0.12 | 0.12 | 0.026 | 0.017 | 0.021 |
| $V_3$ | 0.14 | 0.13 | 0.13 | 0.028 | 0.020 | 0.024 |
| S.E. ± | 0.004 | 0.006 | 0.004 | 0.001 | 0.001 | 0.001 |
| C.D. at 5 % | 0.012 | 0.017 | 0.009 | 0.004 | 0.004 | 0.002 |
| **Interaction (FxV)** | | | | | | |
| S.E. ± | 0.007 | 0.010 | 0.009 | 0.002 | 0.002 | 0.002 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| Pooled | Y X F | Y X V | Y X F X V | Y X F | Y X V | Y X F X V |
| S.E. ± | 0.004 | 0.005 | 0.009 | 0.001 | 0.001 | 0.002 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| C.V. % | 12.46 | 17.40 | 15.06 | 13.08 | 20.69 | 16.19 |

* and ** Indicate significance of values at P= 0.05 and 0.01, respectively NS= Non-significant

**Table 4 : Effect of chemical fertilizers and vermicompost on leaf potassium content (%) and potassium uptake (kg/ha) of banana cv. GRAND NAINE**

| Treatments | Potassium content (%) | | | Potassium uptake (kg/ha) | | |
|---|---|---|---|---|---|---|
| | 2008-09 | 2009-10 | Pooled | 2008-09 | 2009-10 | Pooled |
| **Fertilizer levels (F)** | | | | | | |
| $F_0$ | 1.32 | 1.22 | 1.27 | 0.145 | 0.087 | 0.116 |
| $F_1$ | 2.28 | 2.17 | 2.23 | 0.449 | 0.293 | 0.371 |
| $F_2$ | 2.38 | 2.20 | 2.29 | 0.473 | 0.323 | 0.398 |
| S.E. ± | 0.044 | 0.048 | 0.032 | 0.019 | 0.014 | 0.027 |
| C.D. at 5 % | 0.127 | 0.137 | 0.092 | 0.054 | 0.039 | 0.167 |
| **Vermicompost (V)** | | | | | | |
| $V_0$ | 1.89 | 1.79 | 1.84 | 0.219 | 0.136 | 0.177 |
| $V_1$ | 1.91 | 1.82 | 1.87 | 0.305 | 0.214 | 0.260 |
| $V_2$ | 2.06 | 1.85 | 1.96 | 0.441 | 0.268 | 0.354 |
| $V_3$ | 2.11 | 2.00 | 2.05 | 0.458 | 0.310 | 0.388 |
| S.E. ± | 0.051 | 0.055 | 0.037 | 0.022 | 0.016 | 0.013 |
| C.D. at 5 % | 0.147 | 0.158 | 0.092 | 0.063 | 0.045 | 0.078 |
| **Interaction (FxV)** | | | | | | |
| S.E. ± | 0.088 | 0.095 | 0.088 | 0.038 | 0.027 | 0.040 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| Pooled | Y X F | Y X V | Y X F X V | Y X F | Y X V | Y X F X V |
| S.E. ± | 0.046 | 0.053 | 0.092 | 0.016 | 0.019 | 0.033 |
| C.D. at 5 % | NS | NS | NS | NS | NS | NS |
| C.V. % | 8.85 | 10.21 | 9.52 | 21.27 | 23.11 | 22.31 |

* and ** Indicate significane of values at P=0.05 and 0.01, respectively NS=Non-significant

pooled results.

*Effect of vermicompost* :

The data presented in Table 3, revealed that application of vermicompost significantly altered the phosphorus content and uptake in leaf of banana during both the years and in pooled results. Application of 8kg vermicompost per plant($V_3$) gave the highest the phosphorus content and uptake in leaf of banana over control during both the years and in pooled , however, it remained at par with treatment $V_2$ (6kg vermicompost per plant) in the year 2008-09, 2009-10 and pooled results. Significantly registered the minimum phosphorus content and uptake (kg/ha) in leaf of banana under the application of without vermicompost ($V_0$) during the first year and second the year as well as in pooled results.

**Potassium content (%) and uptake(kg/ha) by leaf of banana**

*Effect of fertilizer* :

In Table 4 data showed that potassium content and uptake in leaf of banana was significantly influenced by fertilizer in both the years and in pooled results. Application of 300-90-200g NPK per plant ($F_2$) registered the highest potassium content and uptake in leaf of banana, but it was at par with treatments $F_1$ (150-45-100g NPK per plant) during both the years and in pooled results. Significantly the minimum potassium content and uptake in leaf of banana was obtained under control($F_0$) during the 2008-09, 2009-10 and in pooled results.

*Effect of vermicompost* :

The data in Table 4 showed that different levels of vermicopost influenced significantly on potassium content and uptake in leaf of banana in both the years and in pooled results. Application of 8kg vermicompost per plant ($V_3$) remain comparable with treatment $V_2$ (6kg vermicompost) per plant and recorded significaltly the higher potassium content and uptake in leaf of banana during both the years and in pooled results. Significantly the minimum potassium content and uptake in leaf of banana was registered with the treatment $V_0$ (without vermicompost) in both the years and in pooled results

The nitrogen, phosphorus and potassium content and uptake in leaf of banana plant were significantly highest with application of 300-90-200g NPK per plant ($F_2$), however, treatment 150-45-100g NPK per plant ($F_1$) did not differ significantly with $F_2$. This results accordance with the findings of Hegde and Srinivas, (1991) and Bhalerao *et al*. (2009), they reported that the available nitrogen content in soil after harvest of banana crop increased with increasing level of nitrogen application and was highest at level of 350g per plant and nutrient (NPK) uptake by crop was highest where nitrogen was applied at 250g N per plant.

The nitrogen, phosphorus and potassium content and uptake in leaf of banana (Table 2) , were significantly highest with application of 8kg vermicompost per plant ($V_3$). It was statistically at par with treatment 6kg vermicompost per plant ($V_2$). The steady and increased availability of nutrient from vermicompost might have resulted in increased uptake of nutrient by plant was also reported by Rajkhowa *et al.* (2000). The present results are in accordance with the finding of Senapati *et al.* (1984), who reported that vermicompost is very important organic manure that can be used in the crop production. It contains 2-10 times more utilizable nutrient than the soil. Further, these results are substantial with the findings of Naik and Babu (2005) and Athani *et al*. (2007) in guava.

**Interaction effect of fertilizer levels and vermicompost :**

The interactive effects between fertilizer levels and vermicompost (FxV), (YxF), (YxV), and (YxFxV) in yield,content and uptake in leaf of banana were found non significant during both the years as well as in pooled results.

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